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Washington Naval Yard

Washington, D.C.
CERCLIS #DC91700243100

Site Exposure Potential

The Washington Naval Yard (WNY) is located on 25 hectares in a mixed residential/industrial area bordering the Anacostia River in southwestern Washington, D.C. The Anacostia River feeds into the Potomac River 2.4 km downstream from the site, and the Potomac River discharges to Chesapeake Bay approximately 180 km farther downstream (Figure 1). The WNY began operations as a shipbuilding yard in 1799, making it the longest continuously operating Federal facility in the country (CH2M Hill 1998a). A dredged navigation channel is maintained at 90 to 180 m wide, and 6.1 m deep, from just upstream of the site to the mouth of the River (USGS 1982a, b, c).

Activities at the WNY varied greatly over the past two centuries. Ship construction predominated until the mid-1800s, when ordnance research and production began. Ordnance production was the primary site activity from early in this century until the end of World War II, when administrative activities became dominant (CH2M Hill 1998a). Because of the variety of site activities, numerous bulk hazardous materials have been used at the site (Mahmud 1994; Baker Environmental, Inc. 1996). Table 1 provides a description of the hazardous wastes associated with the investigative sites at WNY.

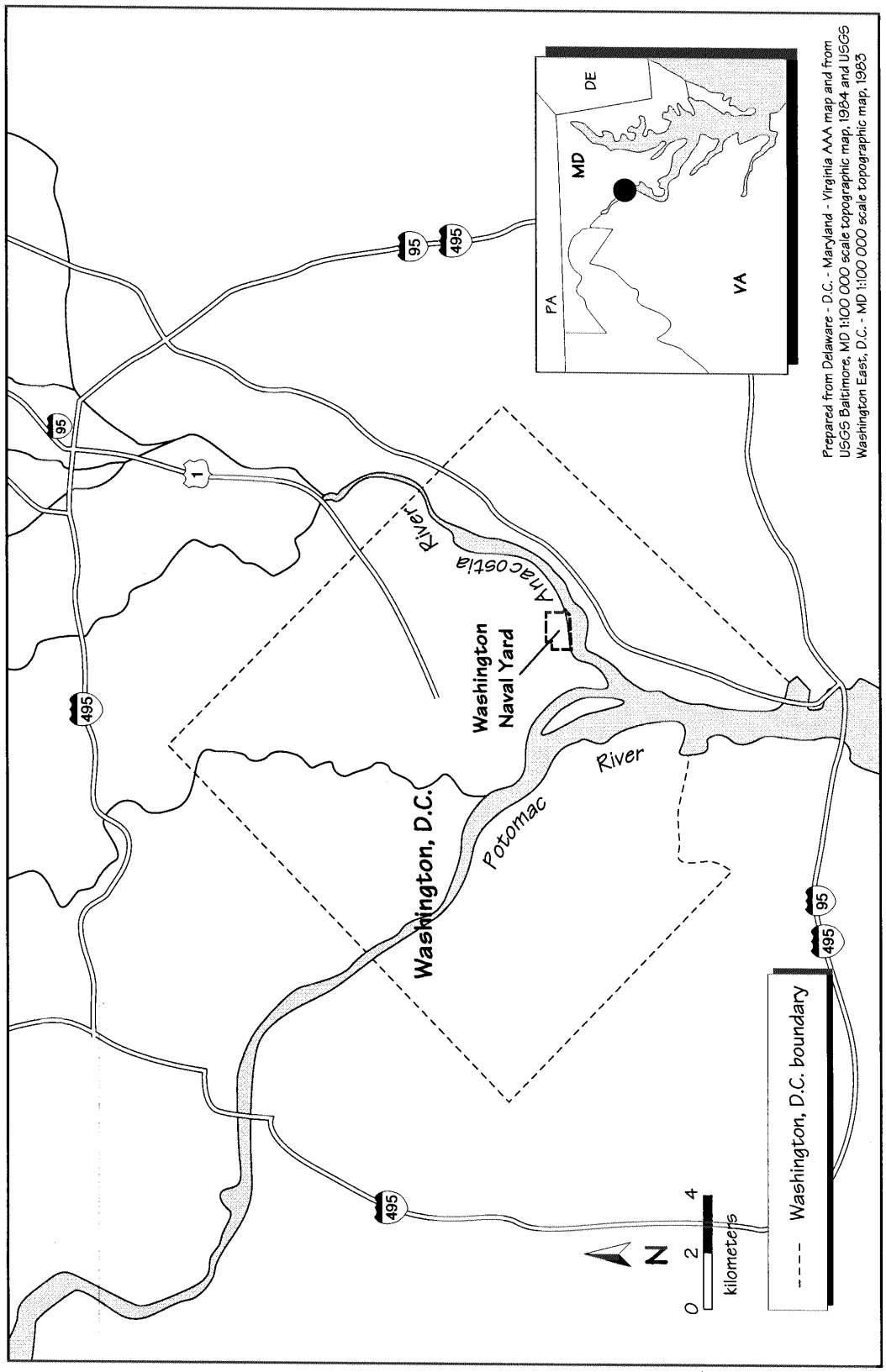

Figure 1. Location of Washington Naval Yard, Washington D.C.

On July 16, 1997, EPA and the Navy entered into a consent order to perform a RCRA Facility Investigation (RFI) at WNY (CH2M Hill 1998a). Under RCRA authority, stormwater drains at sites 6 and 14 were removed in late 1997 (Figure 2). A soil removal is planned at several locations identified as site 10, a series of residential buildings (CH2M Hill 1998a,b,c).

The WNY was proposed for inclusion on the National Priorities list on March 6, 1998 (63 FR 11340).

The WNY is characterized by relatively low, flat, deeply dissected topography. The site lies on terrace deposits of alluvial clay, silt, sand, and gravel and filled areas of the Anacostia River.

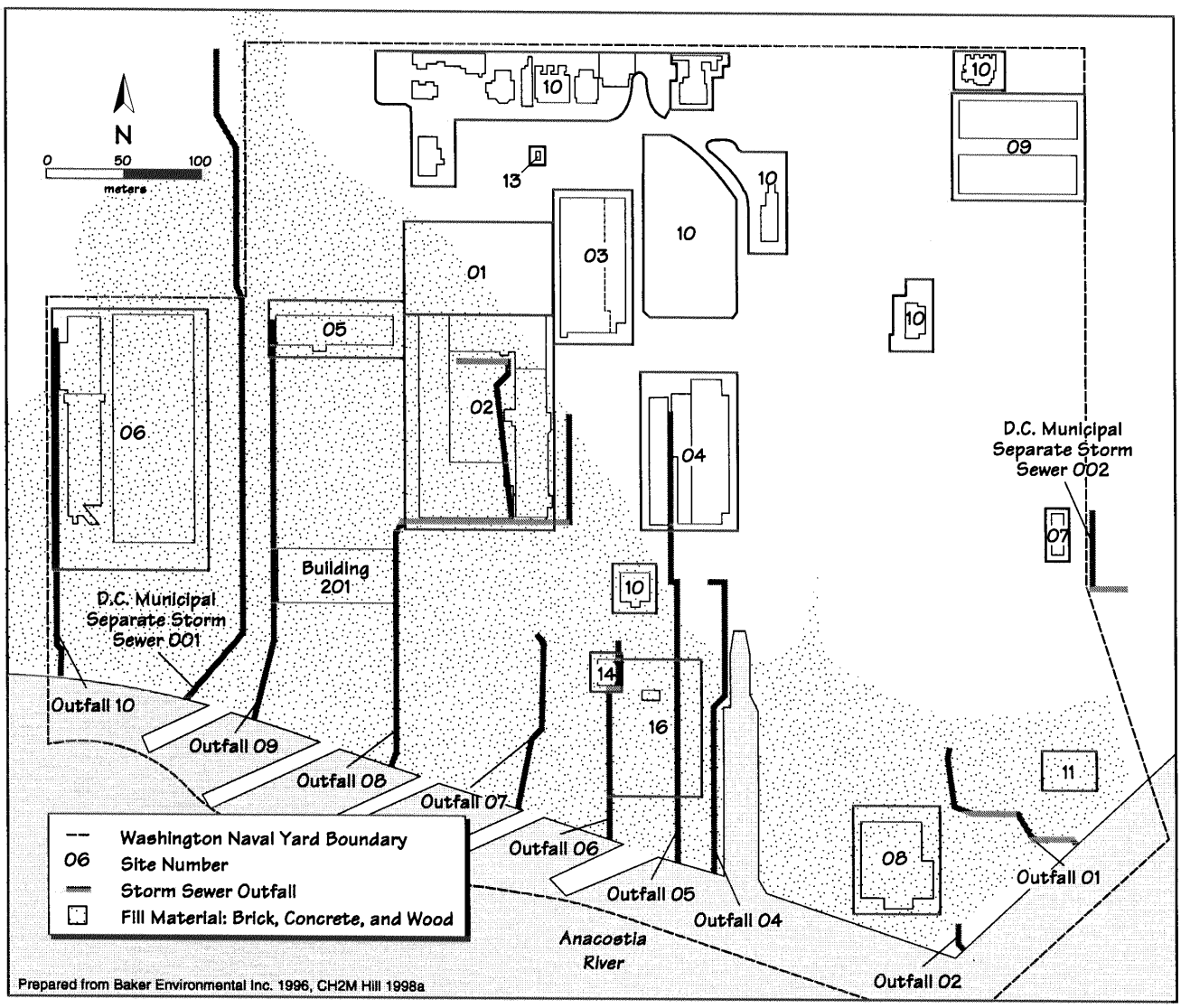

Figure 2. The Washington Naval Yard study area.

Table 1. Activities at the Washington Naval Yard.

Site No.	Dates Used	Materials Deposited	Type of Activities (past)	Type of Activities (present/future)
1	1850 - present	heavy metals, solvents, perchloroethylene, carbon tetrachloride, dichloroethane, vinyl chloride	Foundry, machine shop, and a laundry facility	Racquetball, offices
2	1855 - present	solvents (including carbon tetrachloride), metals, acids	Gun cartridge shop and machine shop	Offices
3	1887 - 1977	heavy metals, acids, cleaners, caustics, solvents	Plating and gun shop	Demolished
4	late 1840's - present	oils, paints, solvents, acids, lacquer, phenols, cyanide, metals (lead, chromium, cadmium, antimony)	Copper rolling mill, cartridge case shop, metal pressing shop, chemical laboratory, seamen shop, primer shop, furnace room, metal pressing shop, Naval Exchange center	Naval Exhibit Center, offices
5	1845 - present	solvents, phenols, metals	Gun mount shop, metal fabricating	Offices
6	1904 - present	boiler blowdown, PCBs, fly ash, dioxins, solvents, metals (lead, chromium, cadmium, antimony)	Boiler house, Incinerator	NA
7	1911 - 1938	solvents (perchloroethylene, carbon tetrachloride, dichloroethene, vinyl chloride)	Receiving station laundry	Parking structure
8	1942 - present	paint, oil	Paint and oil storage	The CPO Club
9	1944 - present	mercury, laboratory solvents, mineral oil	Chemical and gauge laboratories	Offices
10	Late 1800's - present	lead	Residential structures (20+).	Residential housing, Historic Society Center
11	NA	NA	Former incinerator	Parking lot and offices
13	? - present	PCBs	Equipment storage	NA
14	? - present	PCBs	Equipment storage	NA
16	? - 1994	petroleum hydrocarbons, mercury, BTEX	Underground storage tanks	NA
Bldg. 201	? - present	Ash, metals, freon 11, compressor oil, waste paint, and thinners	Incinerator	NA

NA = not available
Source: Mahmud 1994, Baker Environmental Inc. 1996; CH2M Hill 1998a,b,c; EPA 1999.

The fill ranges from approximately 1.5 to 5 m thick, and consists primarily of poorly sorted silt, sand, and some gravel with brick, concrete, wood, and other debris. In general, the site slopes gradually southward to the river (CH2M Hill 1998a).

The water table varies from about 5 m bgs in the northern part of the facility to 1 m bgs in the southern part. General groundwater transport is south-southwest, toward the Anacostia River (CH2M Hill 1998a).

NOAA Trust Habitats and Species

The habitat of primary concern to NOAA is the lower Anacostia River, a relatively short but wide tributary of the Potomac River (Figure 1). The lower river adjacent to the WNY is tidal freshwater, approximately 400 m wide, with a sand and silt substrate. The NOAA trust resources of concern in the Anacostia River are the anadromous alewife, blueback herring, American shad, white perch, and striped bass (Table 2). The catadromous American eel also uses the watershed (Leasner 1998).

Alewife, blueback herring, and American shad enter the Potomac and Anacostia rivers from March through May to spawn in upstream tributaries. Juveniles return to the ocean and the lower Chesapeake Bay by the following fall. Striped bass also enter the Potomac and lower Anacostia rivers in the spring and typically spawn in tidal freshwater areas in the basin. Spawning has not been documented near the site, but the tidal freshwater habitats near the site appear to have suitable flows and depths for spawning bass. White perch are found in tidal fresh- to estuarine waters within the basin and are common near the site. The catadromous American eel is found throughout the Chesapeake Bay basin and is likely found near the site (Leasner 1998).

There are numerous recreational fisheries in the Potomac and lower Anacostia rivers. Both shoreline and boat angling are popular year-round near the confluence of the two rivers about 2 km downstream of the site. White perch and striped bass are heavily fished during their spring residence near the site. The nearest commercial fishery is in estuarine portions of the Potomac River approximately 60 km downstream of the site (Leasner 1998). The Distict of Columbia advises against any consumption of catfish, carp, or eel taken from the Anacostia River from its confluence with the Potomac River to the Maryland border because of PCB

Table 2. Anadromous and catadromous fish species in the Anacostia River near the Washington Naval Yard (Leasner 1998).

SPECIES		Habitat Use			Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Area	Adult Forage	Comm. Fishery	Recr. Fishery
ANADROMOUS FISH						
Alewife	*Alosa pseudoharengus*		◆			
American shad	*Alosa sapidissima*		◆			
Blueback herring	*Alosa aestivalis*		◆			
Striped bass	*Morone saxatilis*	◆	◆			◆
White perch	*Morone americana*	◆	◆			◆
CATADROMOUS FISH						
American eel	*Anguilla rostrata*			◆		

and chlordane concentrations in edible tissue (Collier 1999).

Site-Related Contamination

Data collected during several recent site investigations indicated that groundwater, soil, outfalls, and sediments at the WNY contained elevated concentrations of trace elements and organic compounds, including PAHs and PCBs (Clark and Gower 1995; Baker Environmental 1996; CH2M Hill 1998a,b). Table 3 summarizes the maximum reported contaminant concentrations, along with appropriate screening guidelines.

The highest concentrations of most trace elements in soil were found near the eastern or western site boundary, and the highest trace element concentrations in groundwater also were found along the western boundary WNY (Table 3). Soil lead concentrations near the western boundary were more than 1000 times higher than the mean U.S. concentration, and may result primarily from paint chips in the soil (Dinardo 1999). The maximum sediment concentrations of lead, were at AR-SED01, also near the western boundary of the site. Sediment also was collected from stormwater outfalls draining the site. The maximum reported concentrations of mercury in sediment were from outfall 10 and at nearby station AR-SED01 (Table 3). Recent data suggest free-phase elemental mercury at Site 16, less than 25 m from the Anacostia River.

High sediment concentrations of phenanthrene, a PAH compound, and PCBs were found in sediment samples from the Anacostia River. The maximum PCB concentration in sediment was found at AR-SED01, near outfall 10, which had higher PCB concentrations than any other outfall at the site (CH2M Hill 1998a).

Sediments from the WNY had elevated concentrations of cadmium, copper, lead, mercury, zinc, PCBs, and phenanthrene compared to samples collected about 1.2 km upstream.

Summary

Elevated concentrations of trace elements are found in soil, groundwater, and sediment at the Washington Navy Yard. Lead concentrations were more than one thousand times screening guidelines for soil and sediment. PCB concentrations one hundred times screening guidelines were found in the stormwater drainage system and in Anacostia River sediment near outfall discharges. WNY is located along the freshwater tidal reach of the Anacostia River. Anadromous alewife, blueback herring, American shad, white perch, and striped bass are found in the river, and both striped bass and white perch likely spawn near the site.

Table 3. Maximum concentrations of selected contaminants measured at the Washington Naval Yard (Clark and Gower 1995; Baker Environmental 1996; CH2M Hill 1998a,b).

	Water (µg/l)				Soil (mg/kg)			Outfalls (mg/kg)			Sediment (mg/kg)		
	Detection Limit	Ground Water	Location	AWQC [a]	Soils	Location	Mean U.S. [b]	Outfalls	Location	Detection Limit	Sediment		TEL [c]
Trace Elements													
Arsenic	10	61.7	Site 5	190	83.6	Site 5	5.2	144	2	2	9.2	AR-SED04	5.9
Cadmium	5	5.8	Site 6	1.0 [d]	2.5	Site 6	0.06	8.2	4	1	1.8		0.60
Copper	25	3910	Site 5	11 [d]	1130	Site 6	17	1480	4	5	260	AR-SED01	35.7
Lead	3	1080	Site 5	2.5 [d]	18700	Site 10	16	5060	2	0.6	234	AR-SED01	35
Mercury	0.2	0.55	Site 5	0.012 [e]	5	Site 11	0.058	31.7	10	0.1	2.7	AR-SED01	0.17
Nickel	40	3190	Site 5	160 [d]	199	Site 5	13	362	7	8.0	40.7	AR-SED02	18
Silver	10	ND	ND	3.4 [d,f]	0.49	Site 5	0.05	13.0	8	2.0	3.4	AR-SED02	NA
Zinc	20	6570	Site 5	100 [d]	609	Site 11	48	5520	4	4.0	415	AR-SED02	123.1
Organic Compounds													
PCBs	1.0	ND	ND	0.014	20	Site 14	NA	87.81	10	0.008	12	AR-SED01	0.034
Phenanthrene	10	ND	ND	NA	22	Site 7	NA	NM	NM	0.330	12	AR-SED01	0.042
Toxaphene	5	ND	ND	0.0002	ND	ND	NA	NM	NM	0.02	ND	ND	NA

a: Ambient water quality criteria for the protection of aquatic organisms (EPA 1993). Freshwater chronic criteria presented
b: Shacklette and Boerngen (1984), except for cadmium and silver which represent average concentrations in the earth's crust from Lindsay (1979).
c: Threshold Effects Level is the geometric mean of the 15th percentile of the effects data and the 50th percentile of the no-effects data. The TEL is intended to represent the concentration below which adverse biological effects rarely occurred (Smith et al. 1996)
d: Criterion expressed as a function of total hardness; concentrations shown correspond to hardness of 100 mg/L
e: Criterion expressed as total recoverable metal
f: Chronic criterion not available; acute criterion presented
ND: Not detected; detection limit not available.
NA: Screening guidelines not available.
NM: Not measured
AR-SED: Anacosta River Sediment Sampling Locations

Table 4. Comparison of maximum sediment concentration at the Washington Naval Yard and locations approximately 1.2 km upstream.

	Sediment (mg/kg) Upstream [a]	Washington Navy Yard	TEL [b]
Trace Elements			
Arsenic	NM	9.2	5.9
Cadmium	1.72	1.8	0.60
Chromium	103.4	45.5	37.3
Copper	75.6	260	35.7
Lead	138.9	234	35
Mercury	0.341	2.7	0.17
Nickel	NM	40.7	18
Silver	NM	3.4	NA
Zinc	355.0	415	123.1
Organic Compounds			
PCBs	0.7119	12	0.034
Phenanthrene	0.59195	12	0.042

a: Upstream values (Velinsky et al. 1992) AR-1 is downstream of Sousa Bridge, northside of river, upstream from Washington Naval Yard.

b: Threshold Effects Level; concentration below which adverse biological effects were rarely observed; geometric mean of the 15th percentile in the data set) as compiled by Smith et al. 1996.

NA: Screening guidelines not available.

NM: Not measured

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